WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
1.3	**Run 2b DAQ and Trigger Project**	**$4,113,571.00**	**$3,958,243.00**	**$155,328.00**	**1**	**1**	**0**

Notes
WBS Description:

Project includes TDC upgrade, XFT upgrade, L2 upgrade, SVT upgrade, EVB upgrade and L3 PC replacements.

1.3.1	**Run 2b TDC Project**	**$1,183,030.00**	**$1,085,982.00**	**$97,048.00**	**1**	**1**	**0**

Notes
WBS Description:

This summary element covers the development and construction of new time to digital converters (TDC) used in the readout of the CDF central outer tracker (COT).

1.3.1.1	Start Run 2b TDC Subproject	$0.00	$0.00	$0.00	1	1	4

Notes
WBS Description:

Milestone - denoting the start of the Run 2b TDC level 3 subproject

1.3.1.2	**Specification & Development**	**$50,840.00**	**$44,240.00**	**$6,600.00**	**1**	**1**	**0**

Notes
WBS Description:

This summary task covers the new TDC's specification and development on hit time digitization, buffer management, front-end ASDQ and trigger interfaces and data compression

1.3.1.3	**Detailed Design**	**$126,060.00**	**$98,560.00**	**$27,500.00**	**1**	**1**	**0**

Notes
WBS Description:

This summary tasks covers the detailed design for the specifications developed previously.

1.3.1.4	**Prototype - V1.0**	**$143,265.00**	**$143,265.00**	**$0.00**	**1**	**1**	**0**

Notes
WBS Description:

This summary task covers the first round of TDC prototypes including building the boards, debugging and evaulating their performance.

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
1.3.1.5	**Preproduction**	**$151,441.00**	**$151,441.00**	**$0.00**	**1**	**1**	**0**

Notes
WBS Description:

This summary task covers preproduction TDC board fabrication and performance testing with single and multiple boards.

1.3.1.6	**Production**	**$480,898.00**	**$471,850.00**	**$9,048.00**	**1**	**1**	**0**

Notes
WBS Description:

This summary task covers the mass production of the TDC boards including quality assurance tests

1.3.1.7	**Data Concentrator**	**$230,526.00**	**$176,626.00**	**$53,900.00**	**1**	**1**	**0**

Notes
WBS Description:

Summary task covers design, prototyping and production of the Data Concentrator boards.

1.3.1.8	Run 2b TDC Ready for Installation	$0.00	$0.00	$0.00	1	1	3

Notes
WBS Description:

Milestone - denoting that the Run 2b TDC project is ready for installation at B0 (end of level 3 subproject)

1.3.2	**Run 2b Level 2 Project**	**$292,819.00**	**$292,819.00**	**$0.00**	**0**	**1**	**0**

Notes
WBS Description: This summary task covers the development and production of the Level 2 Trigger system

1.3.2.1	Start of Run 2b Level 2 Project	$0.00	$0.00	$0.00	0	0	4

Notes
WBS Description: Milestone denoting the start of the Level 2 Trigger Project

1.3.2.2	Testing and Software work existing L2 Pulsar test stand	$0.00	$0.00	$0.00	0.5	0.5	0

ID	*Resource Name*	*Units*	*Work*	*Delay*	*Start*	*Finish*	*Cost*	*Baseline Cost*	*Act. Cost*	*Rem. Cost*
1	*PhysicistF*	*150%*	*960 hrs*	*0 days*	*Wed 9/4/02*	*Mon 12/30/02*	*$0.00*	*$0.00*	*$0.00*	*$0.00*

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level

"Testing and Software work existing L2 Pulsar test stand" continued

ID	Resource Name	Units	Work	Delay	Start	Finish	Cost	Baseline Cost	Act. Cost	Rem. Cost
2	PostDocF	50%	320 hrs	0 days	Wed 9/4/02	Mon 12/30/02	$0.00	$0.00	$0.00	$0.00
7	PostDocU	200%	1,280 hrs	0 days	Wed 9/4/02	Mon 12/30/02	$0.00	$0.00	$0.00	$0.00

Notes

WBS Description:The prototype Pulsar board will be commissioned as part of a test stand for the Run 2A system. Specific tasks are: finish all mezzanine/Aux cards, Pulsar prototype testing, Rev B if needed; SLINK to PCI software work, test stand software, additional firmware work for testing ALL basic functionalities of prototypes

M&S BOE: N/A

Labor BOE: Based on Run 2A experience

1.3.2.3 Commission L2 Pulsar for each data path - proof of principle te $0.00 $0.00 $0.00 0.5 0.5 0

ID	Resource Name	Units	Work	Delay	Start	Finish	Cost	Baseline Cost	Act. Cost	Rem. Cost
1	PhysicistF	150%	1,680 hrs	0 days	Thu 1/2/03	Mon 7/21/03	$0.00	$0.00	$0.00	$0.00
2	PostDocF	50%	560 hrs	0 days	Thu 1/2/03	Mon 7/21/03	$0.00	$0.00	$0.00	$0.00
7	PostDocU	200%	2,240 hrs	0 days	Thu 1/2/03	Mon 7/21/03	$0.00	$0.00	$0.00	$0.00

Notes

WBS Description:The Pulsar board will be commissioned for each data path coming in to and out of the Level 2 decision system.

M&S BOE: N/A

Labor BOE: Based on Run 2A experience.

1.3.2.4 Preproduction run of Pulsar L2 system $130,515.00 $130,515.00 $0.00 0 0 0

Notes

WBS Description: This task covers the preproduction run of the Level 2 system, which consists of three Pulsar boards, associated mezzanine cards, S-link boards and interface hardware, and L2 decision processor, and will be configured for a vertical slice test.

1.3.2.5 Vertical Slice Test $0.00 $0.00 $0.00 0.5 0.5 0

ID	Resource Name	Units	Work	Delay	Start	Finish	Cost	Baseline Cost	Act. Cost	Rem. Cost
1	PhysicistF	150%	1,200 hrs	0 days	Mon 11/24/03	Tue 4/20/04	$0.00	$0.00	$0.00	$0.00
2	PostDocF	50%	400 hrs	0 days	Mon 11/24/03	Tue 4/20/04	$0.00	$0.00	$0.00	$0.00
7	PostDocU	200%	1,600 hrs	0 days	Mon 11/24/03	Tue 4/20/04	$0.00	$0.00	$0.00	$0.00

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level

"Vertical Slice Test" continued

Notes

WBS Description: This item covers assembly of a vertical slice of the Level 2 system. Specific tasks include: use test stand to fine tune receiver firmware for each data path; system integration at crate level with test stand; L2 code testing for new system.

M&S BOE: N/A

Labor BOE: Based on Run 2A experience

1.3.2.6	**Production run of Pulsar L2 system**	**$162,304.00**	**$162,304.00**	**$0.00**	**0**	**0**	**0**

Notes

WBS Description: Summary task for Production Run of Pulsar Level 2 system: fabrication and purchase of boards, link hardware, L2 decision processors.

1.3.2.7	System Integration standalone w/ test stand	$0.00	$0.00	$0.00	0.5	0.5	0

ID	*Resource Name*	*Units*	*Work*	*Delay*	*Start*	*Finish*	*Cost*	*Baseline Cost*	*Act. Cost*	*Rem. Cost*
1	*PhysicistF*	*150%*	*720 hrs*	*0 days*	*Wed 8/18/04*	*Wed 11/10/04*	*$0.00*	*$0.00*	*$0.00*	*$0.00*
2	*PostDocF*	*50%*	*240 hrs*	*0 days*	*Wed 8/18/04*	*Wed 11/10/04*	*$0.00*	*$0.00*	*$0.00*	*$0.00*
7	*PostDocU*	*200%*	*960 hrs*	*0 days*	*Wed 8/18/04*	*Wed 11/10/04*	*$0.00*	*$0.00*	*$0.00*	*$0.00*

Notes

WBS Description: This item covers integration of the system, first using the Pulsar teststand to drive the Pulsar L2 system, and after studying/optimizing the performance, testing the L2 decision system using test runs with beam data.

M&S BOE: N/A

Labor BOE: Based on Run 2A experience.

1.3.2.8	Pulsar Level 2 subproject ready for installation	$0.00	$0.00	$0.00	0	0	3

Notes

WBS Description: Milestone :

Level 2 subproject ready for installation.

1.3.3	**Run 2b XFTII Project**	**$1,529,842.00**	**$1,529,842.00**	**$0.00**	**0**	**0**	**0**

Notes

WBS Description:

Project to Upgrade the CDF Level 1 tracking trigger system.

1.3.3.1	Start of XFTII Project	$0.00	$0.00	$0.00	0	0	4

Notes

WBS Description:

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
"Start of XFTII Project" continued							

Notes

Milestone - marking the start of the XFTII upgrade project.

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
1.3.3.2	**Finder Boards**	**$638,480.00**	**$638,480.00**	**$0.00**	**0**	**0**	**0**

Notes

WBS Description:

Development of axial and stereo segment Finder boards. These boards take hit information from the COT and find track segments in the COT superlayers.

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
1.3.3.3	Test equipment	$25,000.00	$25,000.00	$0.00	0.5	0	0

ID	*Resource Name*	*Units*	*Work*	*Delay*	*Start*	*Finish*	*Cost*	*Baseline Cost*	*Act. Cost*	*Rem. Cost*
16	*MANDS*	*25,000*	*25,000*	*0 days*	*Thu 11/14/02*	*Fri 11/29/02*	*$25,000.00*	*$0.00*	*$0.00*	*$25,000.00*

Notes

WBS Description:

purchase test equipment for production testing of boards

M&S BOE:

DVM's , oscilloscope, probes.

Labor BOE:

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
1.3.3.4	**TDC Transition Module**	**$31,400.00**	**$31,400.00**	**$0.00**	**0**	**0**	**0**

Notes

WBS Description:

TDC Transition Module: The design for these boards already exists and is being used in the Run 2A design. Additional boards are required for the Stereo Segment Finding. We need 54 boards + 6 spares.

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
1.3.3.5	**Finder Transition Module**	**$21,600.00**	**$21,600.00**	**$0.00**	**0**	**0**	**0**

Notes

WBS Description:

Finder Transition Module: The design for this board already exists and is being used. Additional boards are required for the Stereo segment finders. We need 18 boards + 12 spares

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
1.3.3.6	**Finder3D Tester Board**	$13,600.00	$13,600.00	$0.00	0	0	0

Notes
WBS Description:

Finder 3D Tester Board used to test Stereo Finder boards
need 1 board

1.3.3.7	**Cables**	$8,000.00	$8,000.00	$0.00	0	0	0

Notes
WBS Description:

1.3.3.8	**Linker Modules**	$259,544.00	$259,544.00	$0.00	0	0	0

Notes
WBS Description:

Linker Modules provide the segment linking between axial layers of the COT. It uses input from the Finders and outputs a track list with Pt and Phi information to the rest of the trigger system. We require 12 boards + 4 spares.

1.3.3.9	**Linker Output Module II**	$36,800.00	$36,800.00	$0.00	0	0	0

Notes
WBS Description:
Linker Output Module II captures the track list from Linker Modules and drives the data to the XTRP and the Stereo Association Module. We need 24 boards + 6 spares

1.3.3.10	**Stereo Association Modules**	$296,326.00	$296,326.00	$0.00	0	0	0

Notes
WBS Description:

The stereo association system associates axial XFT tracks with COT SL7 segments to produce 3D tracks in the trigger.

1.3.3.11	**Stereo Association Module Custom Backplane**	$15,260.00	$15,260.00	$0.00	0	0	0

Notes
WBS Description:

Summary task for SAM custom backplane.

1.3.3.12	**Stereo Association Module Tester Board**	$70,552.00	$70,552.00	$0.00	0	0	0

Notes
WBS Description:

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
"Stereo Association Module Tester Board" continued							
	Notes Summary task for SAM tester board. Tester board serves as both data source and sync, allowing SAM testing at full clock speed for a large number of events.						
1.3.3.13	**Stereo Association Module Transition Module**	**$19,216.00**	**$19,216.00**	**$0.00**	**0**	**0**	**0**
	Notes WBS Description: Summary task for SAM transition module.						
1.3.3.14	**Stereo Association Module Clock and Control Board**	**$23,392.00**	**$23,392.00**	**$0.00**	**0**	**0**	**0**
	Notes WBS Description: Summary task for SAM Clock and Control board.						
1.3.3.15	**SAM Clock and Control Transition Module**	**$23,392.00**	**$23,392.00**	**$0.00**	**0**	**0**	**0**
	Notes WBS Description: Summary task for SAM clock and control transition module.						
1.3.3.16	**Level 2 Interface Board**	**$47,280.00**	**$47,280.00**	**$0.00**	**0**	**0**	**0**
	Notes WBS Description: Summary task for XFT-> Level 2 interface board.						
1.3.3.17	XFT Ready for Installation at CDF	$0.00	$0.00	$0.00	0	0	3
	Notes WBS Description: Milestone indicating XFT project complete.						

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
1.3.4	**Event-Builder Upgrade**	**$472,280.00**	**$414,000.00**	**$58,280.00**	**0**	**0**	**0**

Notes

WBS Description:

This summary element covers the Event-Builder upgrade. It includes the complete software development, the construction of a prototype and the construction of the full system.

M&S BOE -

The details of the purchase and all parts are assumed to be equal to the purchase of the present Event Builder hardware. According to somewhat outdated quotes the hardware costs about 500k.

Contingency is included in the sense that these are old quotes and the hardware will only become cheaper, although not by much.

Further Details on the Hardware from a quote from December 2001

Raw cost

32 port ASX 4000 (Marconi)	$215k
16 OC12 PCI cards (ForeRunnerHE 622)	$30k
15 OC-12 PMC carss (Cyclonwe PMC59)	$60k
Total	$305k

Spares

1 Spare switch backbone	$51k
1 Spare switch module	$40k
3 Spare PCI cards	$6k
3 Spare ATM cards	$12k
Total	$109k

Total including spares	$414k
Including 30% contingency	$538k

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
1.3.4.1	Start Event-Builder Upgrade	$0.00	$0.00	$0.00	0	0	4

Notes

WBS Description:

This milestone marks the beginning date for work on the upgrade of the Event-Builder.

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
1.3.4.2	technology evaluation	$0.00	$0.00	$0.00	0.3	0.5	0

ID	*Resource Name*	*Units*	*Work*	*Delay*	*Start*	*Finish*	*Cost*	*Baseline Cost*	*Act. Cost*	*Rem. Cost*
7	*PostDocU*	*40%*	*384 hrs*	*0 days*	*Wed 10/30/02*	*Thu 4/24/03*	*$0.00*	*$0.00*	*$0.00*	*$0.00*

Notes

WBS Description:

Before starting to buy a prototype system an evaluation of the present technology will be performed. This evaluation results in the purchase of a prototype which is the most promising technology. The further schedule has been designed to fit the schedule for an upgrade using more powerful successor of the ATM technology. In case a different technology is chosen the schedule should still be appropriate. The price for the ATM technology is almost certainly higher than an alternative technology like Gigabit Ethernet.

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
"technology evaluation" continued							

Notes
M&S BOE: N/A

Labor BOE:
Based upon experience with the Run 2a system.

1.3.4.3	**upgrade software**	**$58,280.00**	**$0.00**	**$58,280.00**	**0**	**0**	**0**

Notes
WBS description:

This summary element covers the software development for the Event-Builder upgrade. It includes an evaluation of the operating system and the associated driver, the work needed for adjusting the drivers and the remaining software.

1.3.4.4	**construct prototype**	**$103,500.00**	**$103,500.00**	**$0.00**	**0**	**0**	**0**

Notes
WBS Description:

This summary element covers the construction of a prototype. It includes the purchase of the necessary elements, the installation and evaluation of a test stand.

The cost is based on a quote from a possible vendor in December 2001.

1.3.4.5	**construct full size system**	**$310,500.00**	**$310,500.00**	**$0.00**	**0**	**0**	**0**

Notes
WBS Description:

This summary element covers the construction of the full size Event-Builder system. It includes a readiness review, the purchase, installation and evaluation of the hardware and finally the completion of the system.

M&S BOE:

The cost is based on a quote by a possible vendor from December 2001.

1.3.4.6	commissioning of hardware and software	$0.00	$0.00	$0.00	0.3	0.5	0

Notes
WBS Description:

Hardware and software commissioning involves data taking since only then the last problems can be found and corrected. Experience from Run IIa show that 2 month is a reasonable time to fix the most important problems.

M/S BOE: N/A

Labor BOE:
Based upon experience with the Run 2a system.

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
1.3.4.7	Finish Event-Builder Upgrade	$0.00	$0.00	$0.00	0	0	3

Notes
WBS Description:

This milestone marks the end of the Event-Builder upgrade. This means that the hardware is in place and has been proven to technically work, the software development has been finished and its functionality has been proven with real data.

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
1.3.5	**Computer for Level3 PC Farm / DAQ**	**$390,000.00**	**$390,000.00**	**$0.00**	**0**	**0**	**0**

Notes
WBS Description:

This summary task covers the computer purchases for the general DAQ system and the Level-3 PC Farm. The purchases are staged since they are replacing PCs which become obsolete. Prices are based on a recent purchase of similar hardware.

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
1.3.5.1	Start Computers for Level3 PC Farm/DAQ	$0.00	$0.00	$0.00	0	0	4

Notes
WBS Description:

This milestone marks the beginning of the DAQ and Level3 computer purchases.

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
1.3.5.2	**replace 0/10 PCs (2003)**	**$15,000.00**	**$15,000.00**	**$0.00**	**0**	**0**	**0**

Notes
WBS Description:

Summary task describing the purchase of 0 level 3 computers and 10 DAQ computers in FY2003.

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
1.3.5.3	**replace 70/15 PCs (2004)**	**$130,000.00**	**$130,000.00**	**$0.00**	**0**	**0**	**0**

Notes
WBS Description:

Summary task describing the purchase of 70 level 3 computers and 15 DAQ computers in FY2004.

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
1.3.5.4	**replace 140/20 PCs (2005)**	**$245,000.00**	**$245,000.00**	**$0.00**	**0**	**0**	**0**

Notes
WBS Description:

Summary task describing the purchase of 140 level 3 computers and 20 DAQ computers in FY2005.

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
1.3.5.5	Finish Purchase of Computers for Level3/DAQ system	$0.00	$0.00	$0.00	0	0	3

Notes
WBS Description:

This milestone marks the end of the PC purchases for the DAQ and the Level3 PC Farm.

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level
1.3.6	**SVT upgrade**	**$245,600.00**	**$245,600.00**	**$0.00**	**0**	**0**	**0**
	Notes						
	WBS Description:						
	CDF Silicon Vertex Tracker Run 2b upgrade. Upgrade necessary due to differences between SVX IIa and SVX IIb detector geometry. System operation identical to the Run 2a SVT.						
1.3.6.1	Start of SVT upgrade	$0.00	$0.00	$0.00	0	0	4
	Notes						
	WBS Description:						
	Milestone to begin SVT upgrade.						
1.3.6.2	**trackfitter boards**	**$161,600.00**	**$161,600.00**	**$0.00**	**0**	**0**	**0**
	Notes						
	WBS Description:						
	Summary task to produce new Track Fitter boards. New boards necessary to handle SVX IIb geometry.						
1.3.6.3	**Merger boards**	**$84,000.00**	**$84,000.00**	**$0.00**	**0**	**0**	**0**
	Notes						
	WBS Description:						
	Summary task for the production of new SVT Merger boards. These boards are identical to the Run 2a Merger boards.						
1.3.6.4	SVT ready for installation	$0.00	$0.00	$0.00	0	0	3
	Notes						
	WBS Description:						
	Milestone denoting of the completion of the SVT.						
1.3.7	Finish Run 2b Trigger DAQ project	$0.00	$0.00	$0.00	0	0	3
	Notes						
	WBS Description:						
	Milestone marking the end of the CDF Run 2b Trigger/DAQ upgrade subproject.						
1.3.8	**Schedule Contingency and Reportable Milestones**	**$0.00**	**$0.00**	**$0.00**	**0**	**0**	**0**
1.3.8.1	**Reportable Milestones Level 2**	**$0.00**	**$0.00**	**$0.00**	**0**	**0**	**0**
1.3.8.2	**Reportable Milestones - Level 1**	**$0.00**	**$0.00**	**$0.00**	**0**	**0**	**0**
1.31	Start of Run 2b DAQ and Trigger Project	$0.00	$0.00	$0.00	1	1	4
	Notes						
	WBS Description:						

WBS	Name	Cost	M&S	Labor	M&S Cont.	Labor Cont	Level

"Start of Run 2b DAQ and Trigger Project" continued

Notes

Milestone - marking the beginning of the Run 2b DAQ and Trigger upgrade project